Liquidity, Government Bonds and Sovereign Debt Crises

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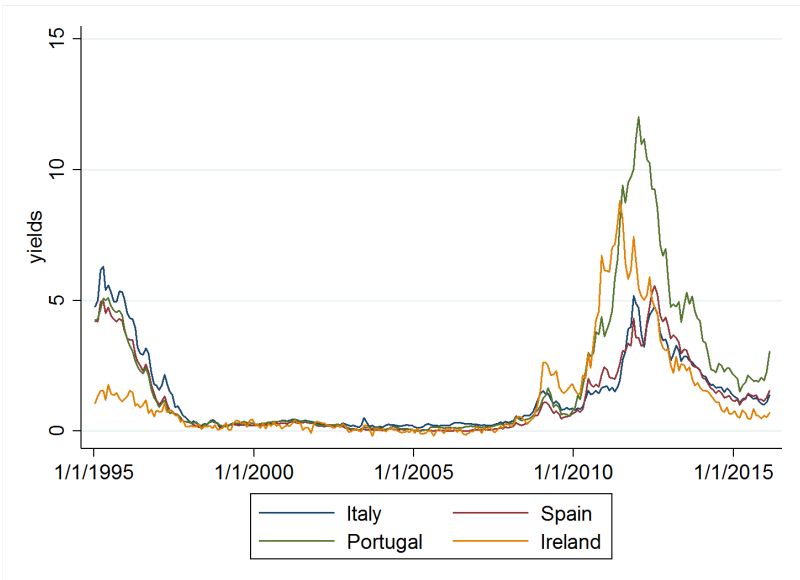
Motivations

Figure: 10-year government bond yield spread



Motivations

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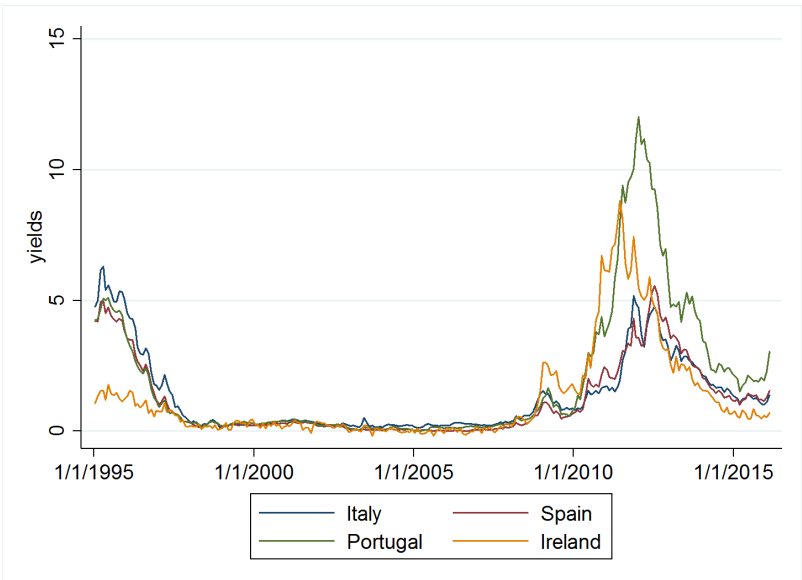

Credit risk

- Fundamentally driven
- Self-fulfilling dynamics

Motivations

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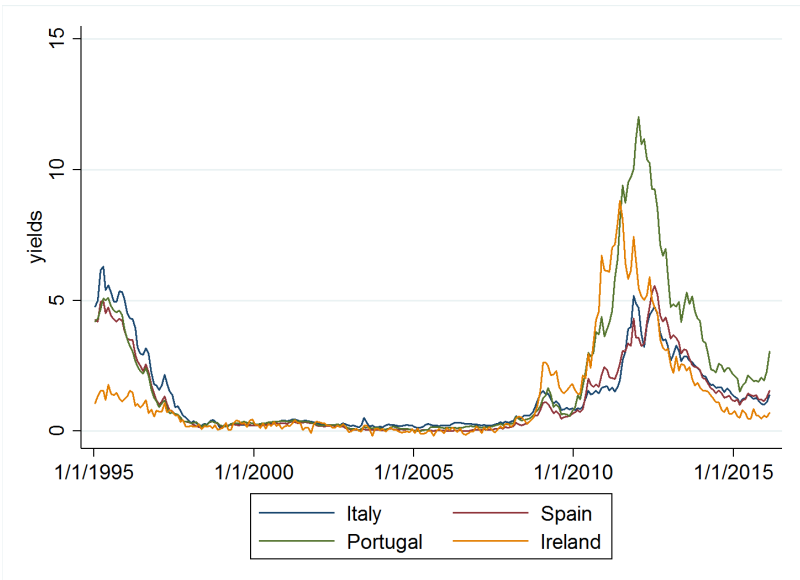


Credit risk

- Fundamentally driven
- Self-fulfilling dynamics

Liquidity

- Market liquidity
- Funding liquidity

Main ideas

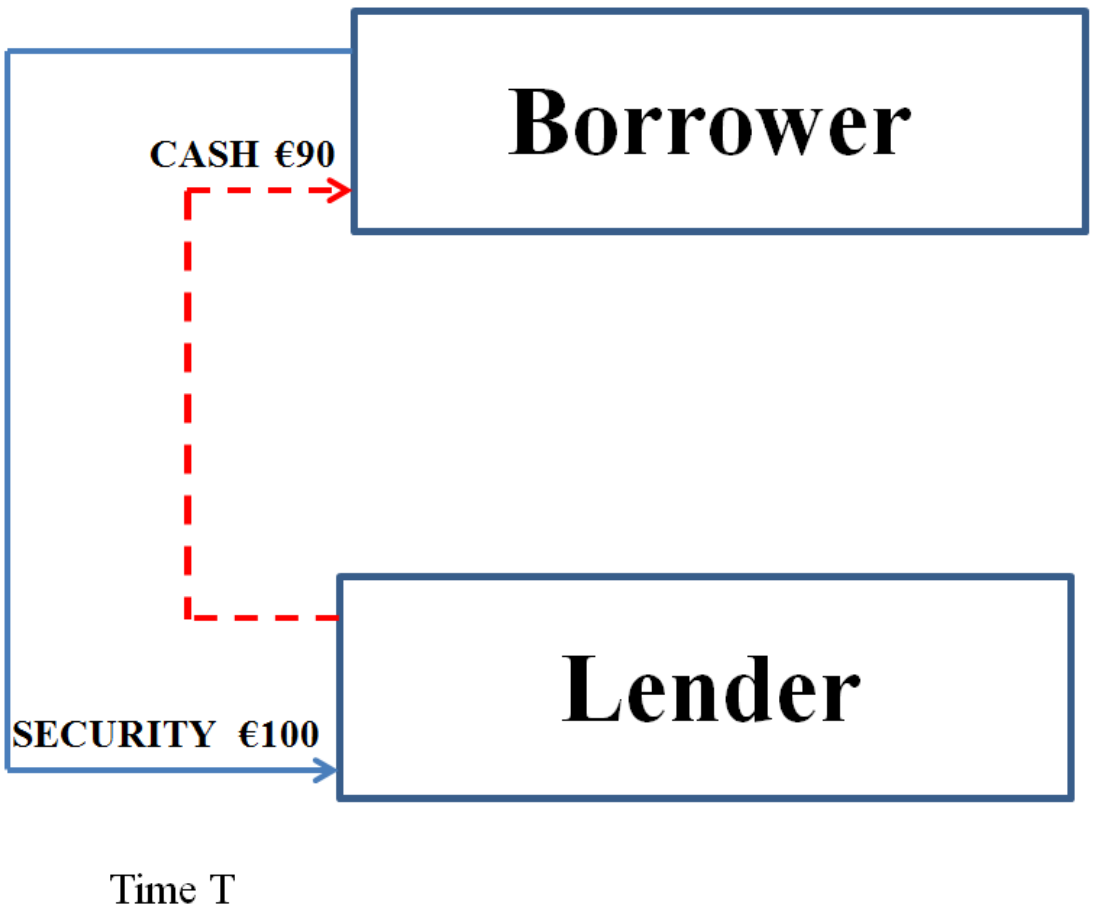
Government bonds are the prime **collateral** in the interbank market

Before the crisis government bonds were **as liquid as money** circulating across banks

During the crisis the rise in **sovereign risk** reduced the funding liquidity of peripheral government bonds

Repurchase agreement

Figure: Bilateral repo contract



Repurchase agreement

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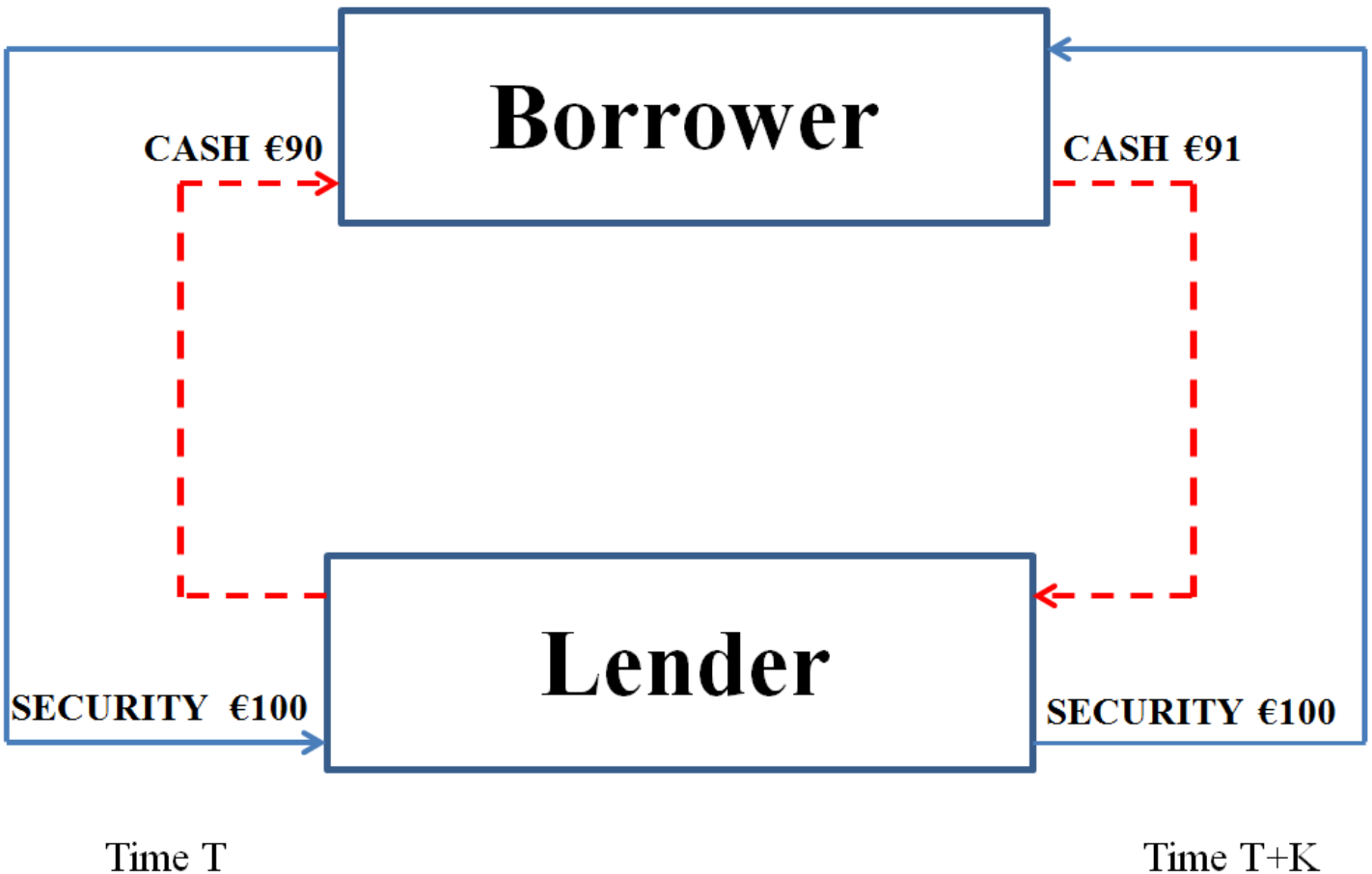
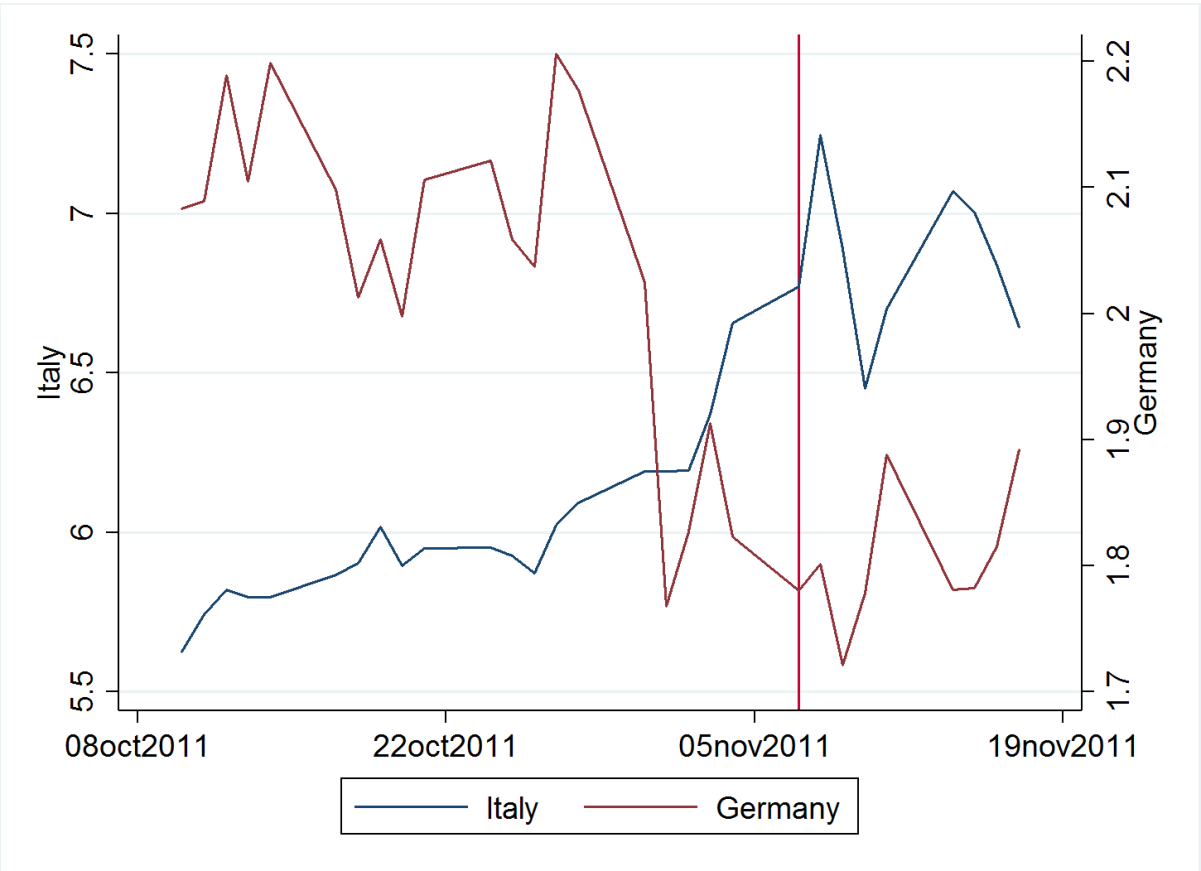


Liquidity shock

Figure: Yields of 10-year Italian (LHS) and German (RHS) govt bonds



"Italian bonds are in a perfect storm at the moment. Real money investors are running away and those investors using Italian bonds to finance will also be clearing the decks now".

FT 9th November 2011 "LCH Clearnet SA raises margin on Italian bonds"

Main contributions

1. Collect data on the European repo market and haircuts on government bonds
2. Study the systemic impact of a liquidity shock in a DSGE model
3. Assess empirically the consequence of a rise in haircuts on sovereign bond yields

Related literature

1. The **US repo market** during the liquidity crisis of 2007-09
   Adrian and Shin (2009, 2010), Brunnermeier (2009), Copeland et al. (2010), Gorton and Metrick (2012), Krishnamurthy et al. (2013)

2. Negative feedback between **haircuts** and the value of **collateral**
   Brunnermeier and Pedersen (2009), Ashcraft et al. (2010), Gârleanu and Pedersen (2009)

3. Link between **banking** and **sovereign** weakness
   Acharya et al. (2011), Gennaioli et al. (2014), Broner et al. (2014), Coimbra (2014), Bocola (2015), Fahri and Tirole (2015)

4. **Liquidity frictions** in a DSGE model
   Kiyotaki and Moore (2012), Del Negro et al. (2012), Jermann and Quadrini (2012), Ajello (2011), Benigno and Nasticò (2013)

Secured and unsecured borrowing

Figure: Repos and unsecured borrowing (total turnover)

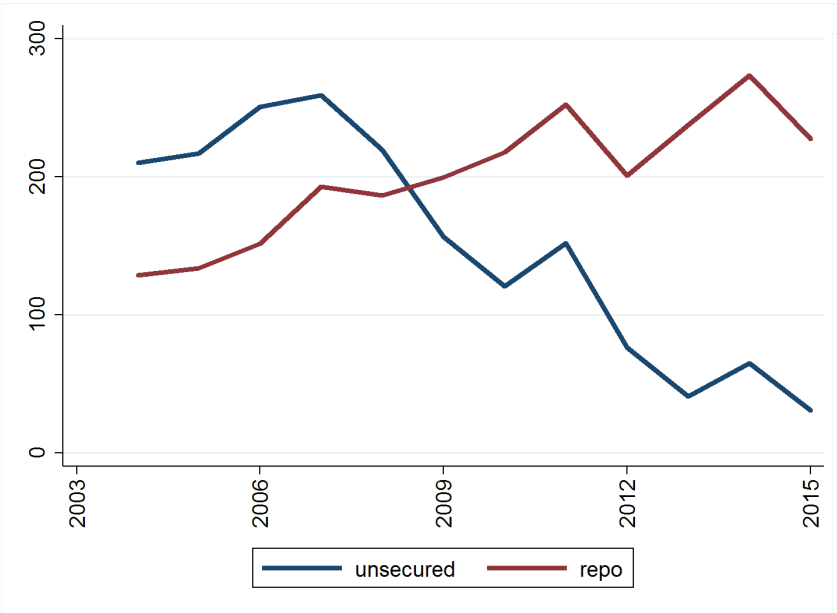
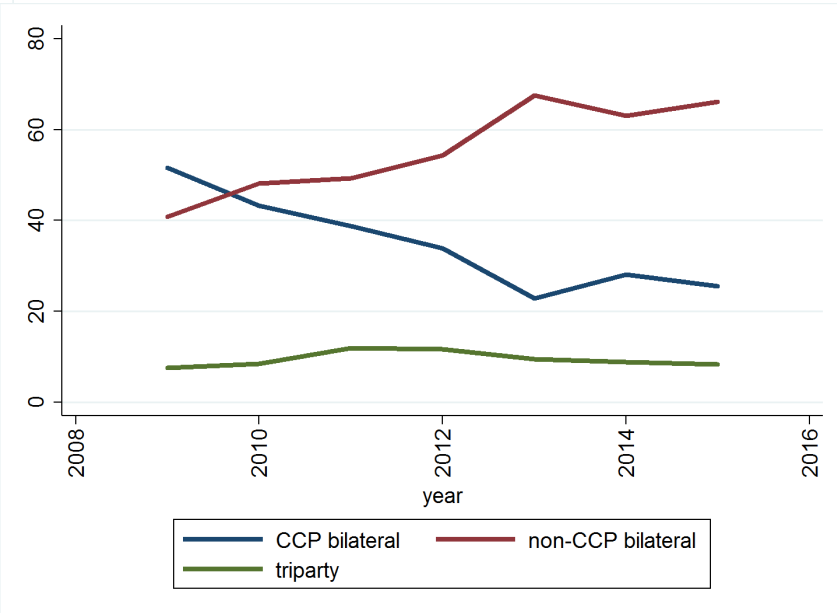


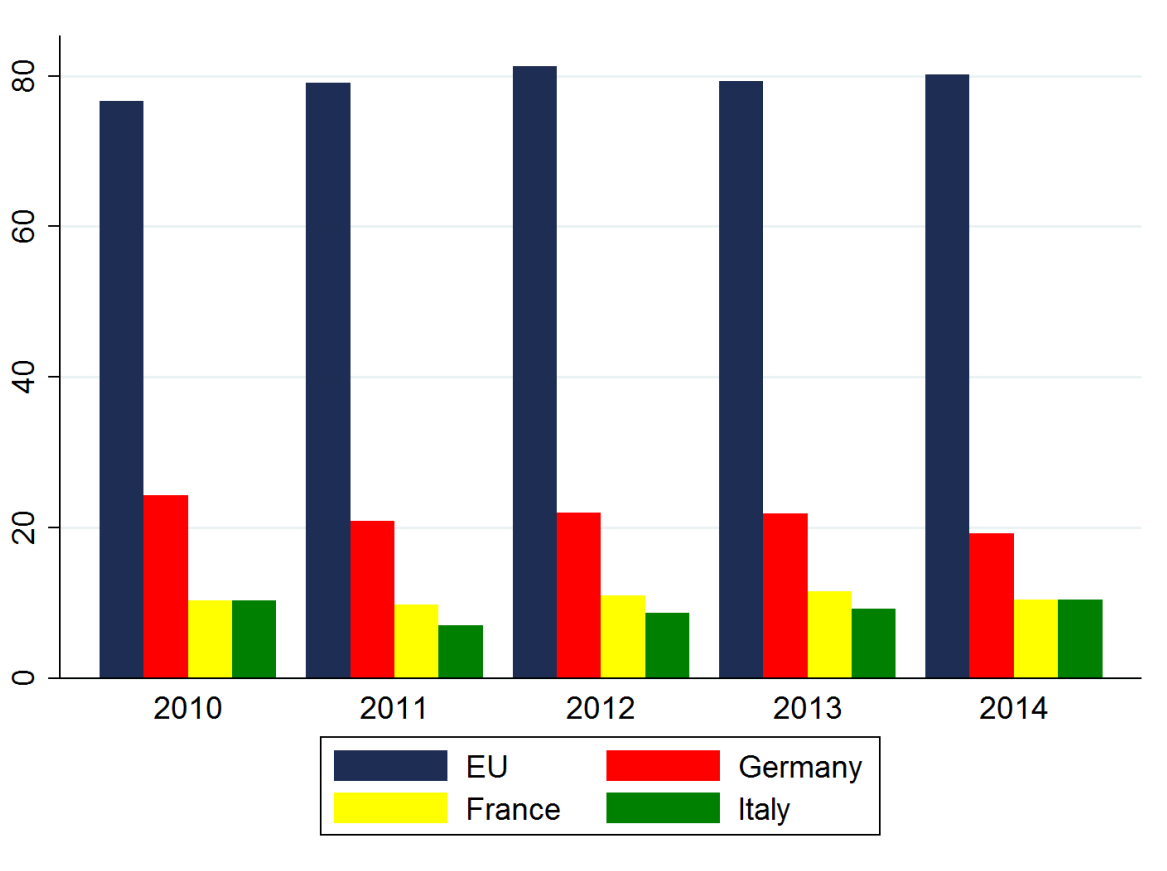
Figure: Shares of bilateral and tri-party repos (in percent of the total)



Source: *European Money Market Survey (ECB)*

Collateral

Figure: Share of collateral in the european repo market (in percent)



Source: European Repo Survey (ICMA)

Yields and haircuts on 10-year govt bonds

LCH Clearnet Ltd

Figure: Ireland

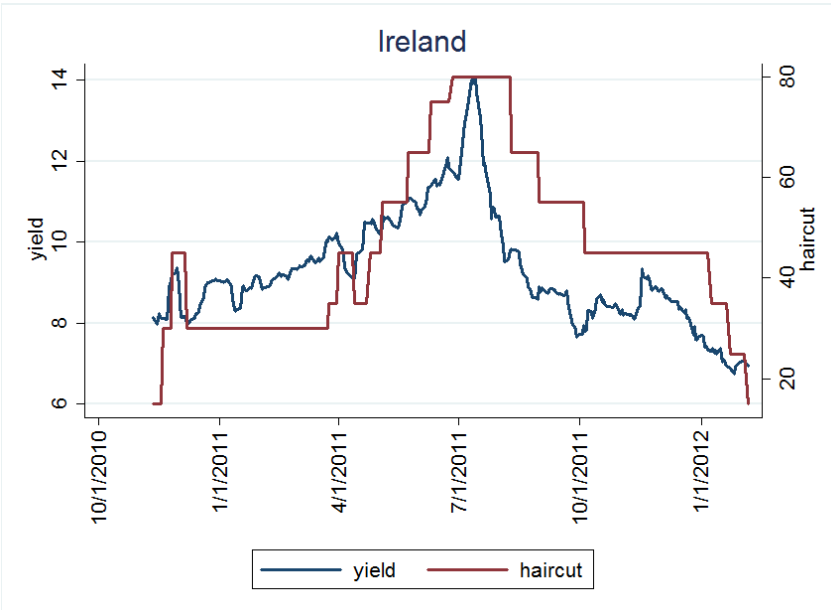
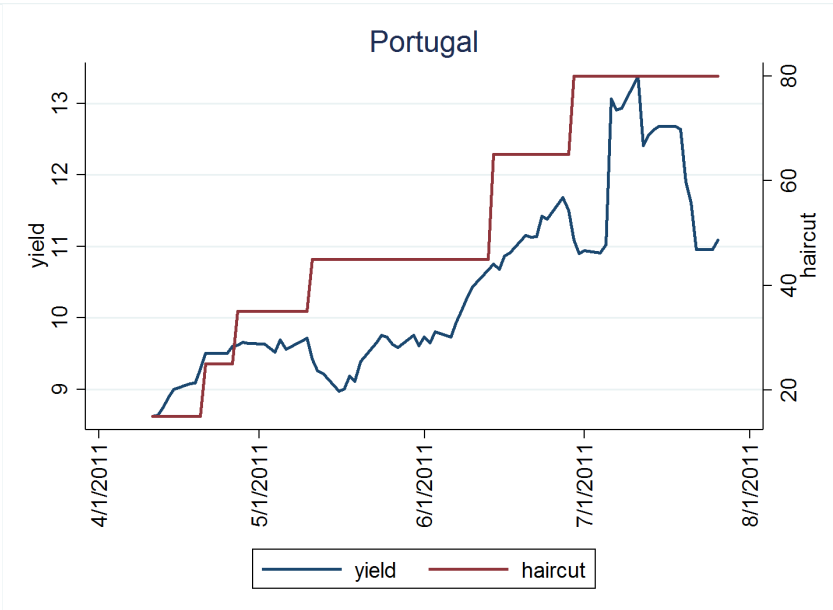


Figure: Portugal



Source: Bloomberg and LCH Clearnet Ltd

Section 2

The model

Model environment

Household
The representative household consists of a continuum of members which are either workers or entrepreuners

Firms
Intermediaries in the production and labour market (nominal and real rigidities)

Government
collects taxes
sets nominal interest rate
unconventional policy

HH structure

Continuum of members j $\in$ [0,1]

At the beginning of each period they receive an idiosyncratic shock determining their profession:

$$j = \begin{cases} \textit{Entrepreuneurs} & \text{with probability } \gamma \\ \textit{Workers} & \text{with probability } 1-\gamma \end{cases}$$

At the end of the period asset and consumption sharing

$$\mathrm{E}_t \sum_{s=t}^{\infty} \beta^{s-t} \left[\frac{C_s^{1-\sigma}}{1-\sigma} - \frac{\omega}{1+\nu} \int_{\chi}^{1} H_s(j)^{1+\nu} dj \right]$$

Portfolio

Table: Household's balance sheet (financial assets)

Assets		Liabilities	
Capital stock:	$q_t K_t$	Equity issued:	$q_t N_t^I$
Others' equity:	$q_t N_t^O$		
Long-term bonds:	$Q_t^L \frac{B^L}{P_t}$		
Short-term bonds:	$Q_t^S \frac{B^S}{P_t}$	Net worth:	$q_t N_t + Q_t^L \frac{B^L}{P_t} + Q_t^S \frac{B^S}{P_t}$

$$N_t = N_t^O + \underbrace{K_t - N_t^I}_{\text{unmortgaged capital}}$$

Table: Return stream

asset	t+1	t+2	t+3	...
N_t	r_t^K	r_t^K	r_t^K	...
B_t^L	1	λ	λ^2	...
B_t^S	1	0	0	...

HH problem

Budget constraint

$$C_t(j) + p_t^I I_t(j) + q_t \left[N_{t+1}(j) - I_t(j) - \lambda N_t\right] + Q_t^L \left[B_{t+1}^L(j) - B_t^L\right]$$
$$+ Q_t^S \left[B_{t+1}^S(j) - B_t^S\right] = r_t^k N_t + W_t(j) H_t(j) + D_t + D_t^I - \tau_t$$

Funding constraints

$$N_{t+1}(j) \geq \underbrace{(1-\theta) I_t(j)}_{\text{borrowing constraint}} + \lambda N_t$$

$$B_{t+1}^L(j) \geq \underbrace{(1-\phi_t) B_t^L}_{\text{liquidity constraint}}$$

$$B_{t+1}^S(j) \geq 0$$

The Government

Intertemporal budget constraint

$$Q_t^L \left(\frac{B_{t+1}^L}{P_t} - \lambda \frac{B_t^L}{P_t} \right) + Q_t^S \frac{B_{t+1}^S}{P_t} + T_t = \frac{B_t^S}{P_t} + \frac{B_t^L}{P_t}$$

Fiscal policy

$$T_t - T = \psi_T \left(\frac{B_t^L}{P_t} - \frac{B^L}{P} \right)$$

Conventional monetary policy

$$R_t = max \left(\pi_t^{\psi_\pi}, 1 \right)$$

The Government

Intertemporal budget constraint

$$Q_t^L \left(\frac{B_{t+1}^L}{P_t} - \lambda \frac{B_t^L}{P_t} \right) + Q_t^S \frac{B_{t+1}^S}{P_t} + T_t = \frac{B_t^S}{P_t} + \frac{B_t^L}{P_t}$$

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Conventional monetary policy

$$R_t = max \left(\pi_t^{\psi_\pi}, 1 \right)$$

Unconventional policy

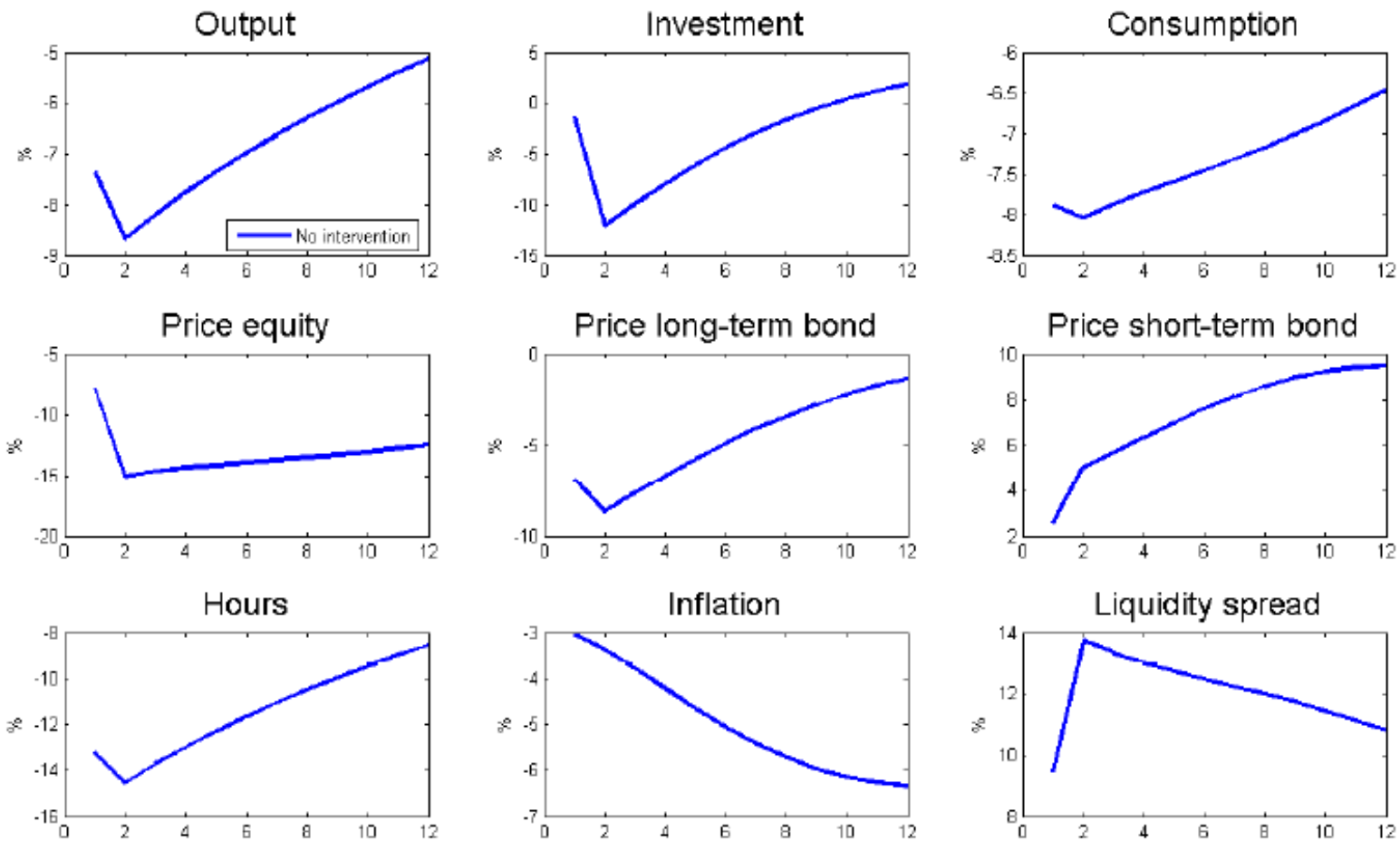
$$\frac{B_{t+1}^S}{K_t} = \psi_B \left(\frac{\phi_t}{\phi} - 1 \right)$$

$$Q_t^S = \frac{1}{R_t}$$

Liquidity shock

Laissez-faire economy

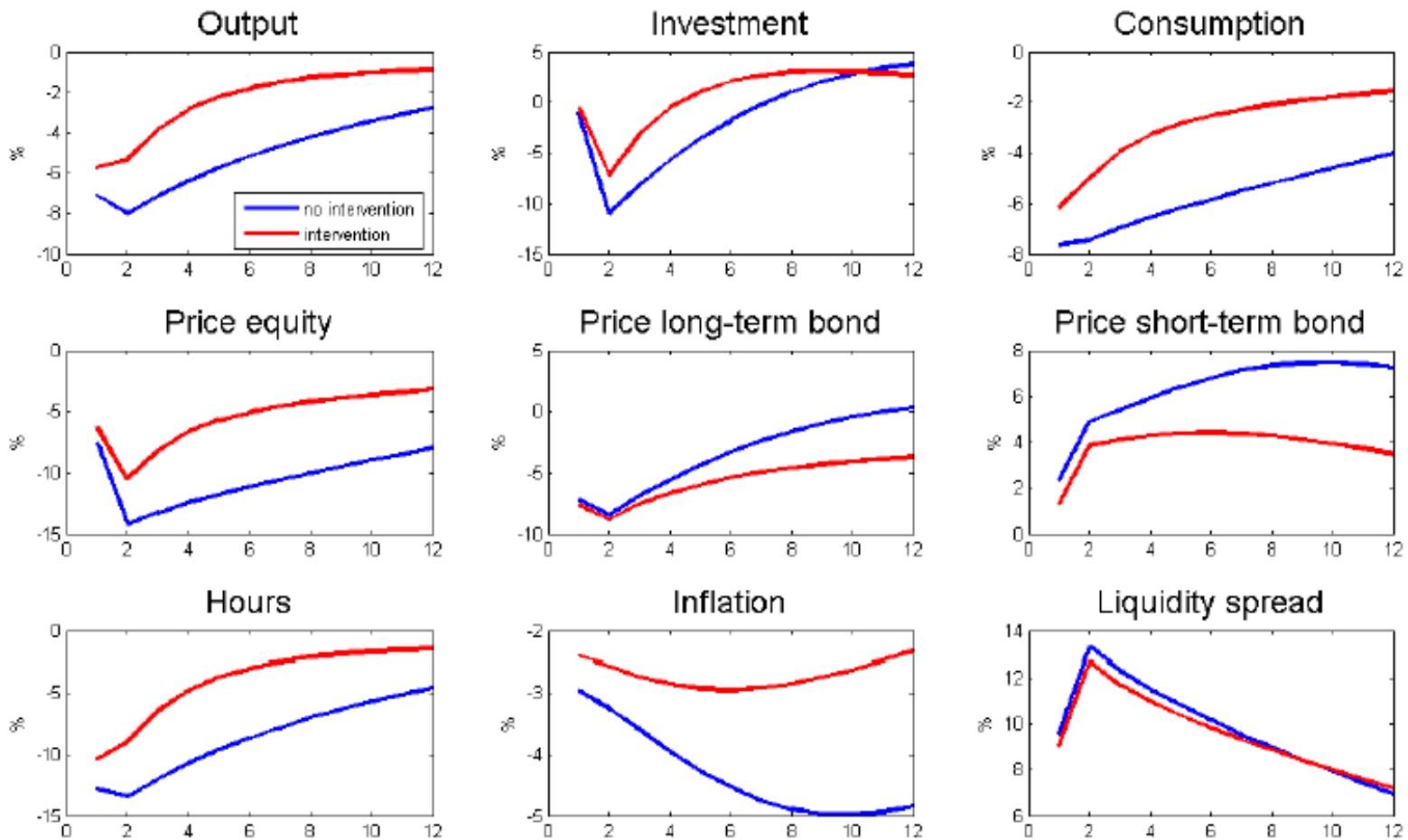
Figure: Impulse response function



Liquidity shock

Unconventional policy

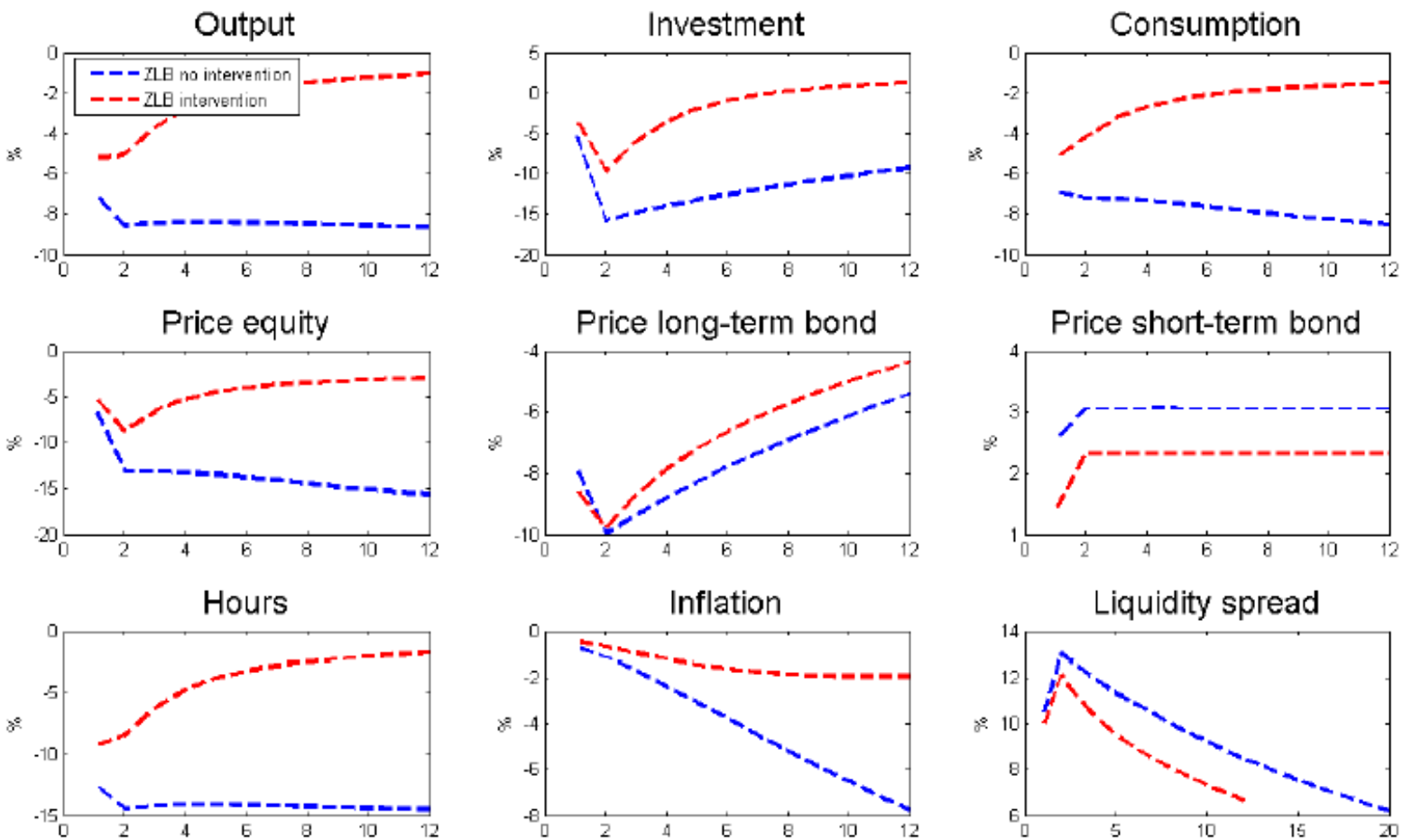
Figure: Impulse response function



Liquidity shock

Zero lower bound

Figure: Impulse response function



Section 3

Empirical analysis

The model

Let $\boldsymbol{y_t} = [h_t, CDS_t, yd_t]'$

$$\boldsymbol{y_t} = B(L)\boldsymbol{y_t} + \boldsymbol{\epsilon_t}$$

where $B(L) = B_0 + \sum_{k=1}^{p} B_k L^k$ and $\boldsymbol{\epsilon_t} \sim (0, \Sigma_\epsilon)$

Flat priors for the coefficient matrices and variance-covariance matrix

Identification of shock

- Narrative approach and High Frequency Identification (HFI)
- Choleski decomposition
- Delay between the announcement and the implementation of changes in haircuts
- Shock to haircut unanticipated (liquidity surprises)

Example of Repo Clear Margin Rate Circular

LCH.CLEARNET

Explore the Archive

Risk Notices Ltd
Risk Notices SA
Default Fund Notices SA
Circulars
Flash infos Bonds & Repos
Flash infos Derivatives
Flash infos Equities
Flash infos Other
Fixed Income Notices Ltd
Legal Notices SA
Membership Notices SA
General Information
General Member Meetings
Press Releases
SA Completion of Application Documentation
SA Clearing Specifications
SwapClear Legal Documentation

Originating department:	Risk Management
Company Circular No:	LCH.Clearnet Ltd Circular No 2815
Service Circular No:	RepoClear: 160
Date:	24 March 2011
To:	All RepoClear Clearing Members

Management of Sovereign Credit Risk for RepoClear Service

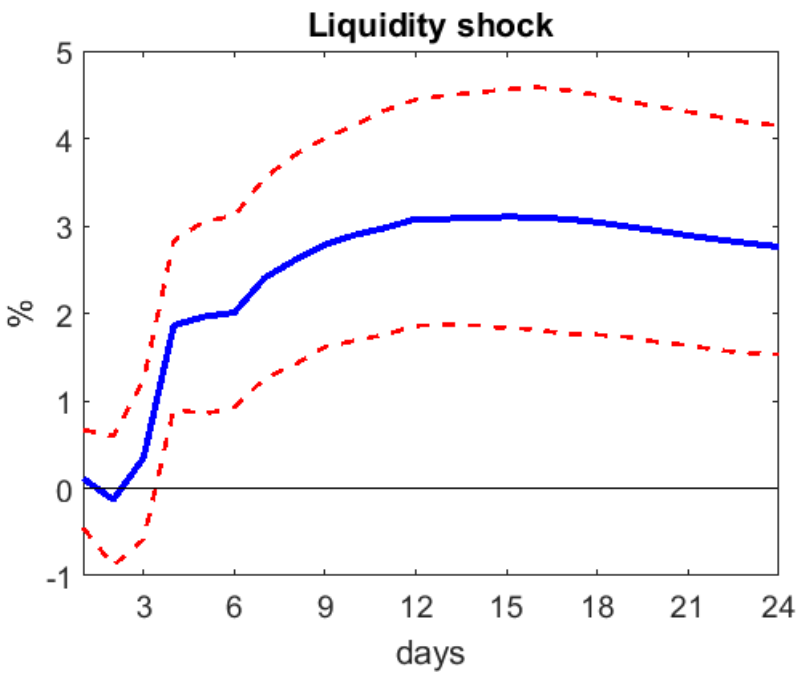
In accordance with the Sovereign Credit Risk Framework and in response to the yield differential of 10 year Irish government debt against a AAA benchmark, LCH.Clearnet Ltd has revised the risk parameters for Irish government bonds cleared through the RepoClear service. The additional margin required for positions of Irish government bonds will consequently be increased to 35% for long positions; this amount will be adjusted for the current bond price. Short positions will pay a proportionately lower margin.

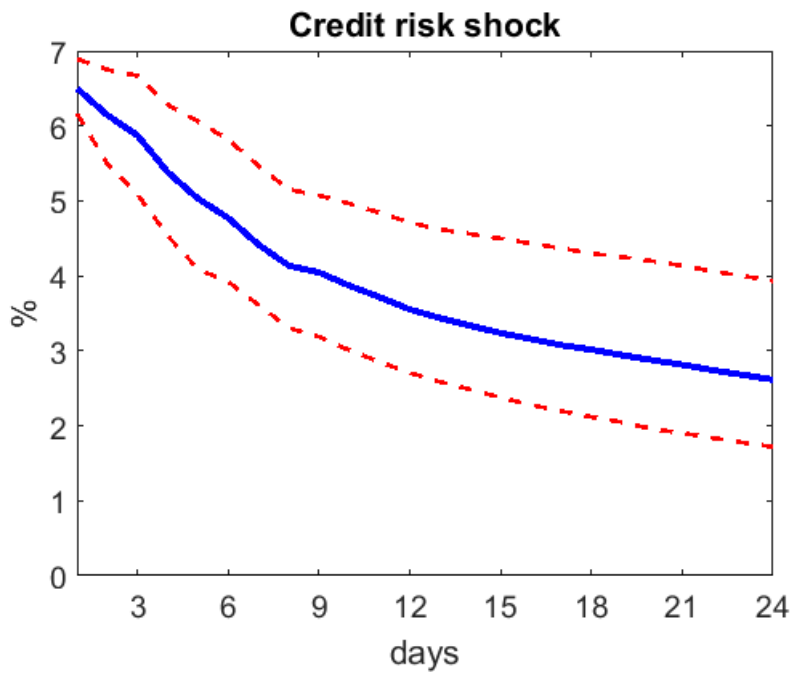
1. This decision is based solely on publicly available yield spread data and in no way represents a forward looking market view. LCH.Clearnet will continue to monitor yield spreads closely and keep the parameters under close review in accordance with the Sovereign Credit Risk Framework.
2. The additional margin will be reflected in a margin call/repayment on **Friday 25 March 2011**.
3. Report 74 (available on the LCH.Clearnet Member Reporting website) will detail any further changes in the margin levels charged under this framework.
4. This circular supersedes LCH.Clearnet Ltd Circular No 2746 dated 06 December 2010.
5. For further information please contact either Tom Chapman (tom.chapman@lchclearnet.com) +442074266338 or Lianne Arnold (lianne.arnold@lchclearnet.com) +442074267376

Christopher Jones
Executive Director, Head of Risk Management

Impulse response function

Figure: Impulse response function of government bond yields





Robustness test

Impulse responses by local projections (Jorda)

Hansen (2000) test: threshold effect on CDS

State dependent model:

$$yd_t = \boldsymbol{\delta}_{\boldsymbol{L}}' \boldsymbol{X}_{\boldsymbol{t-1}} + \beta shock + u_t^L \qquad \text{if } CDS_t \leq 600$$
$$yd_t = \boldsymbol{\delta}_{\boldsymbol{H}}' \boldsymbol{X}_{\boldsymbol{t-1}} + \beta shock + u_t^H \qquad \text{if } CDS_t > 600$$

Impulse response function

Figure: linear model

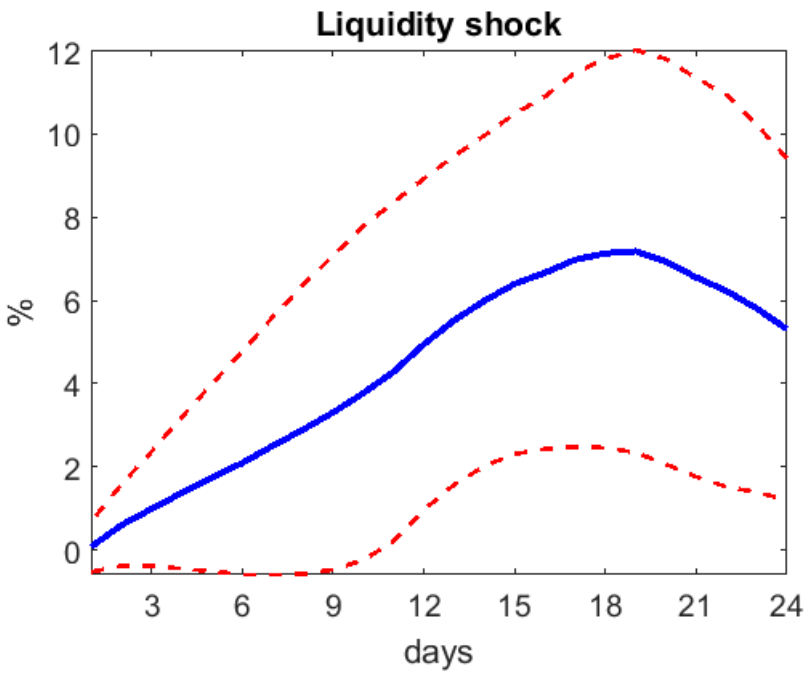
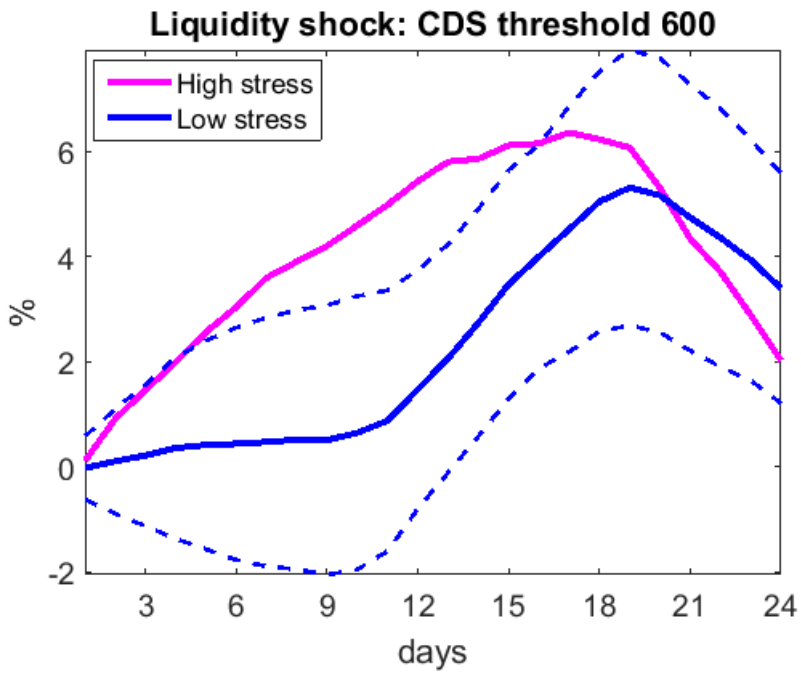


Figure: state-dependent model



Conclusion

- Liquidity channel of the European financial crisis through the European repo market
- Effectiveness of unconventional monetary policy in a liquidity crisis
- Lack of a liquid asset

Thank you for your attention !